FIG.1
PRIOR ART

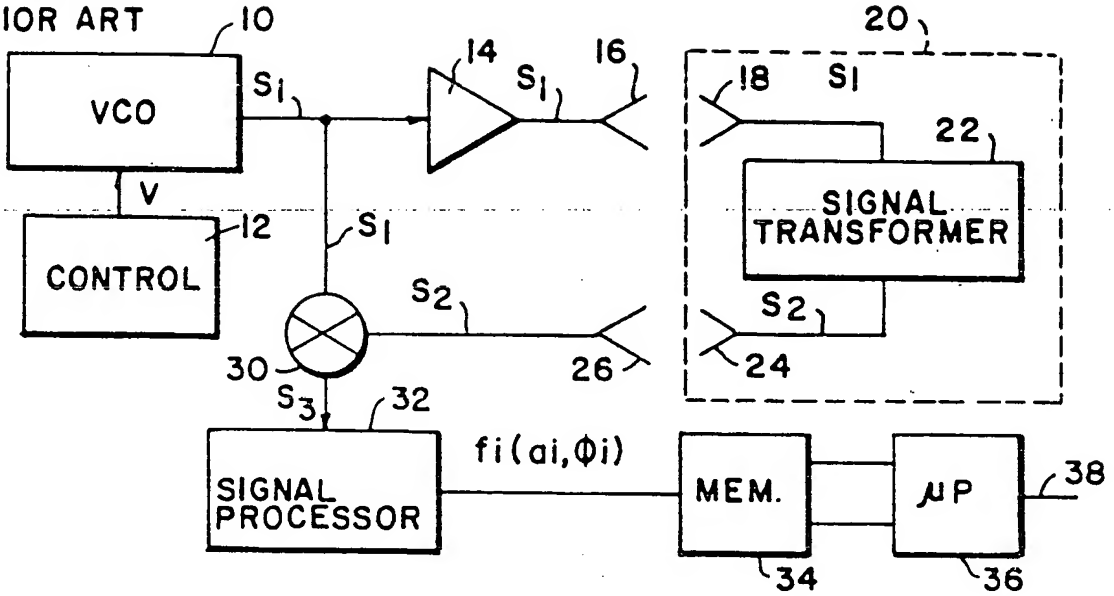


FIG.2
PRIOR ART

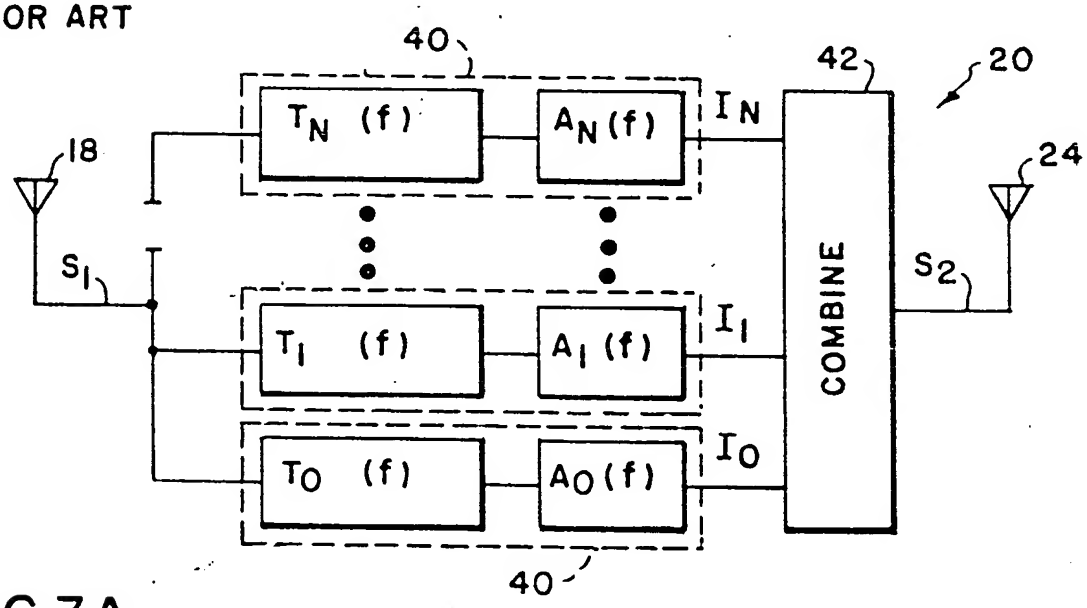


FIG.3A
PRIOR ART

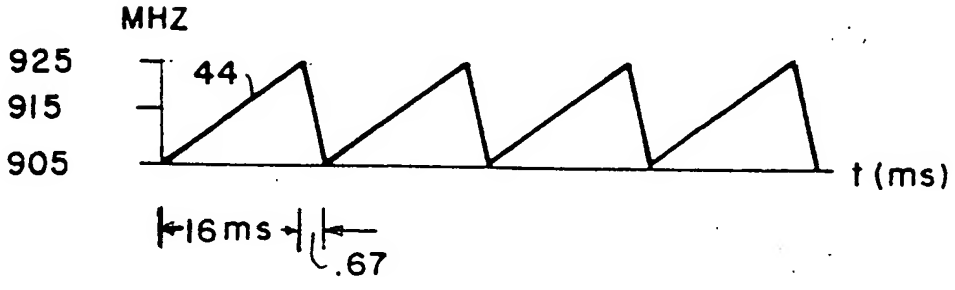


FIG.3B
PRIOR ART

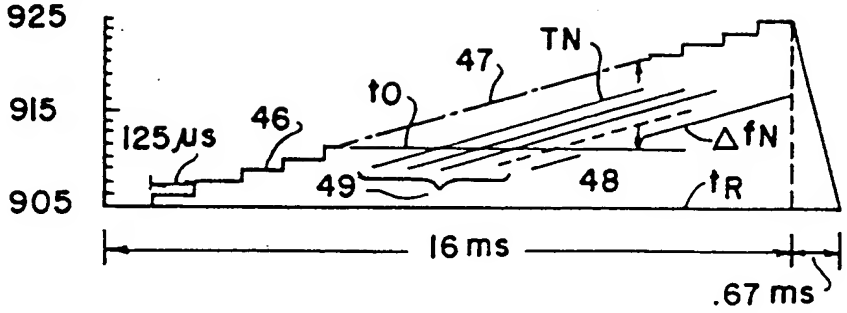


FIG.4
PRIOR ART

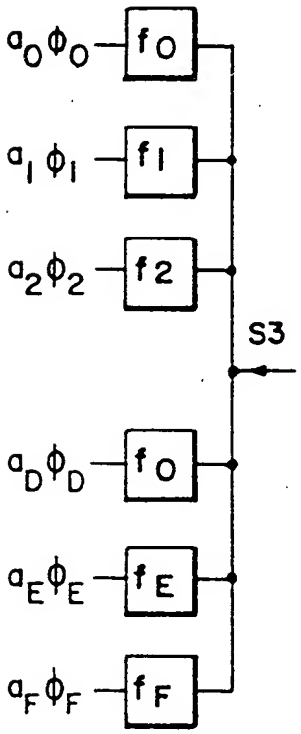


FIG.5
PRIOR ART

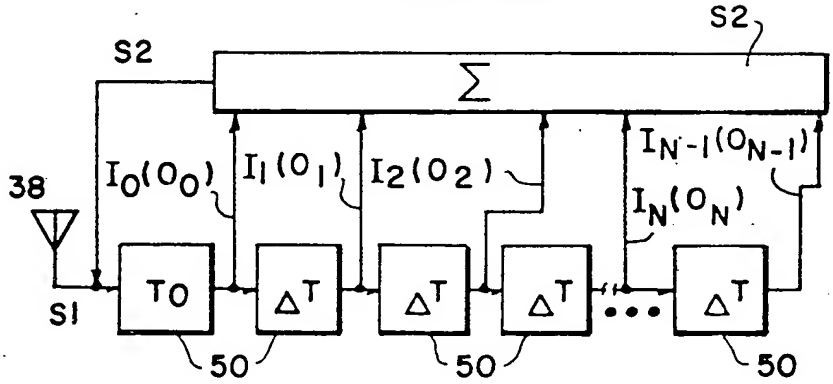


FIG.7
PRIOR ART

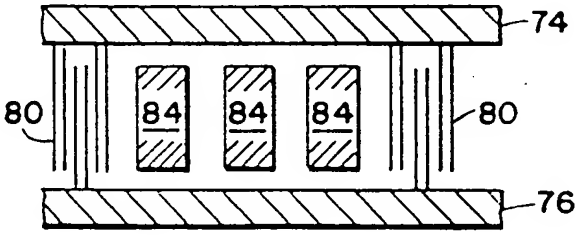


FIG.6
PRIOR ART

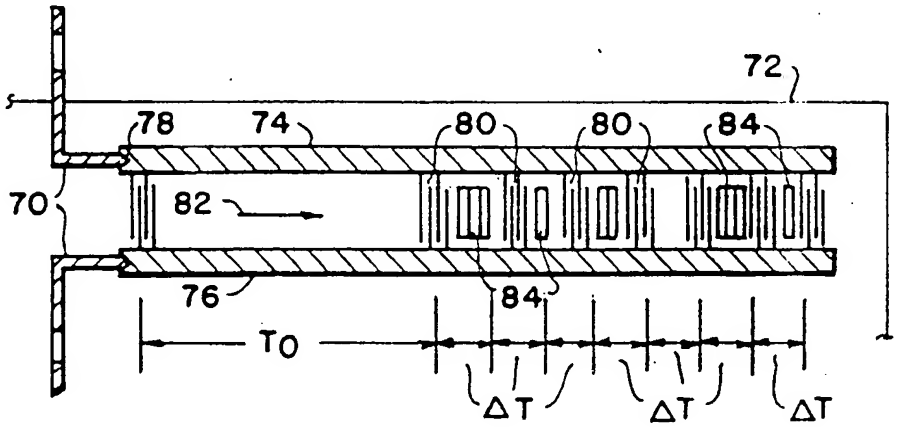


FIG.8A
PRIOR ART

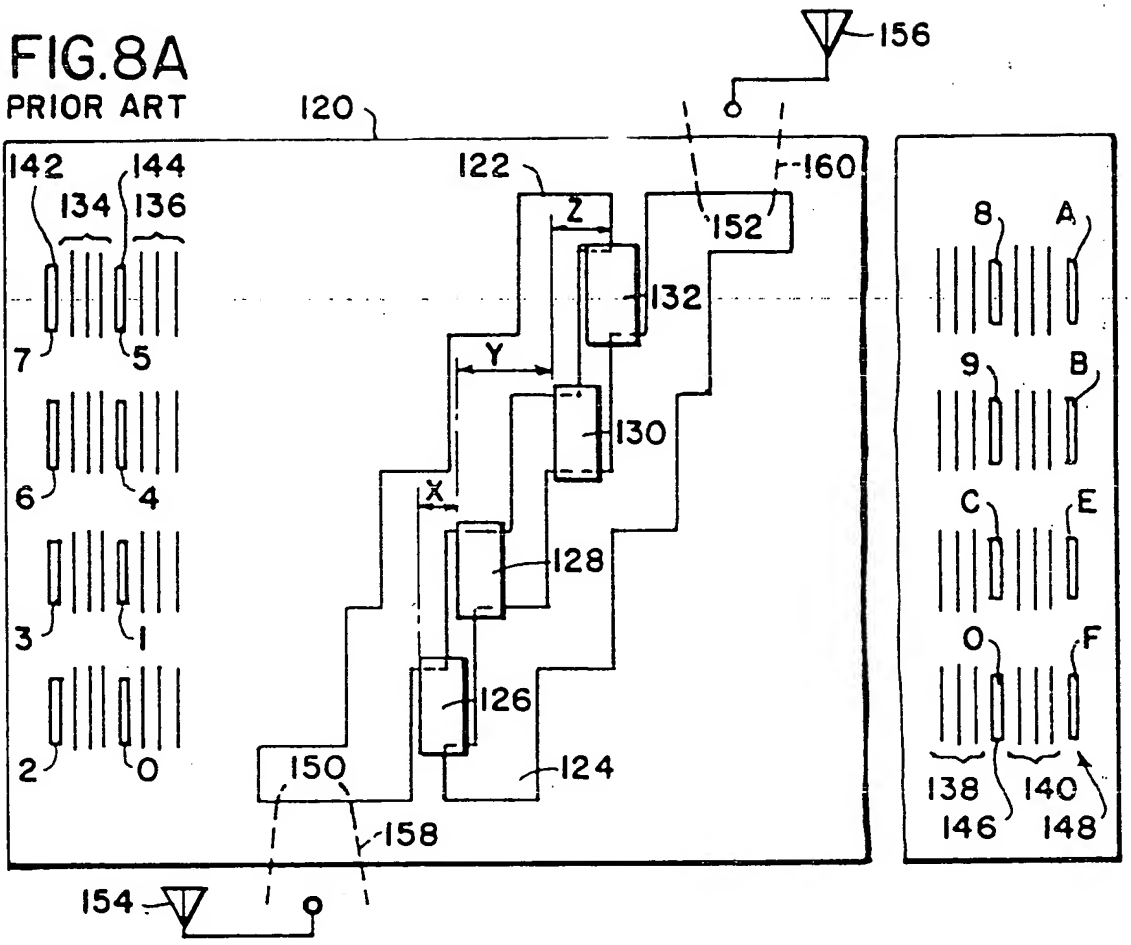


FIG.8B
PRIOR ART

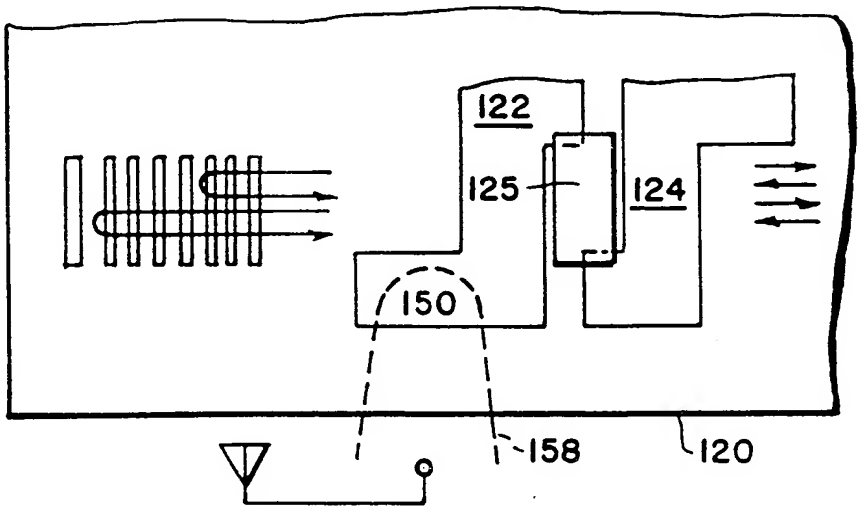


FIG.9A

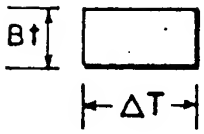


FIG.9B

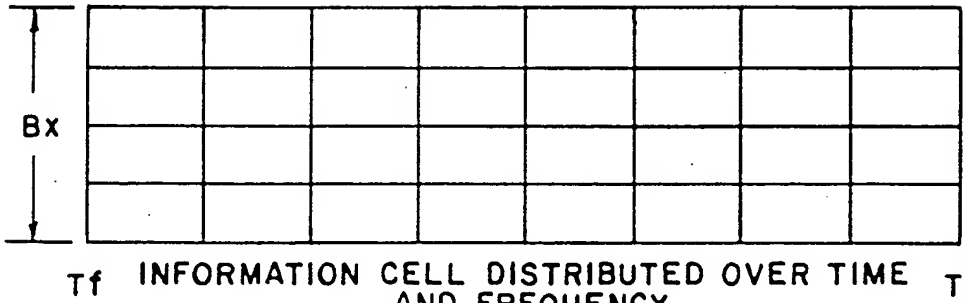


FIG.9C

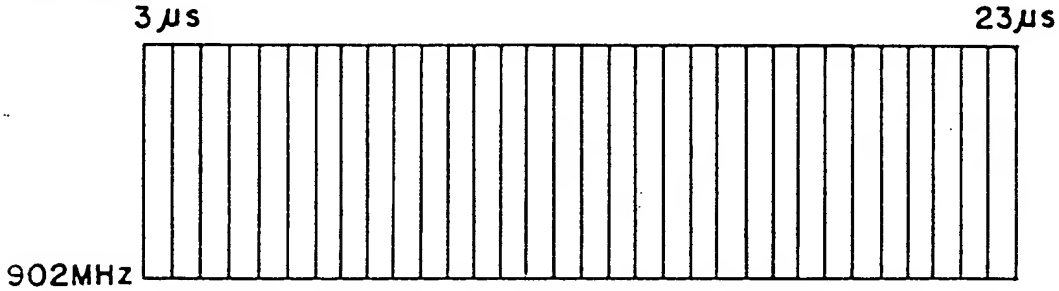


FIG.10A

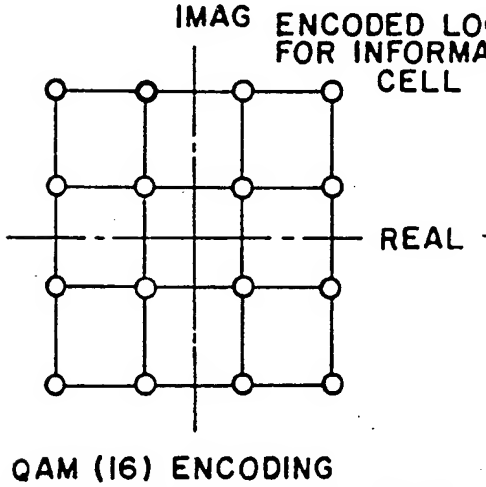


FIG.10B

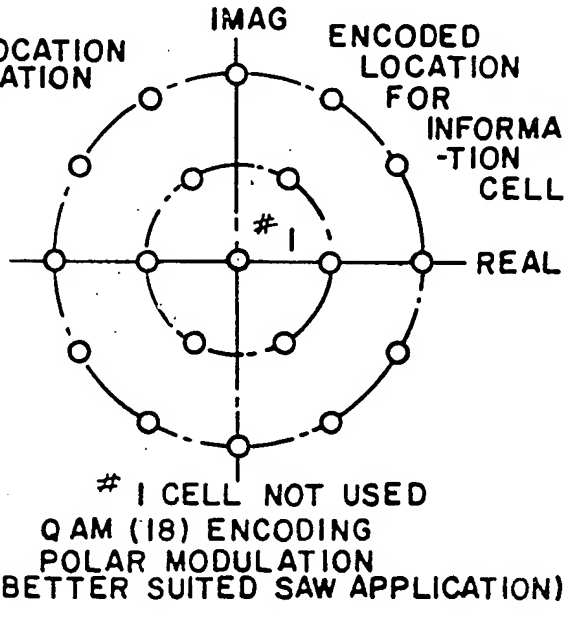
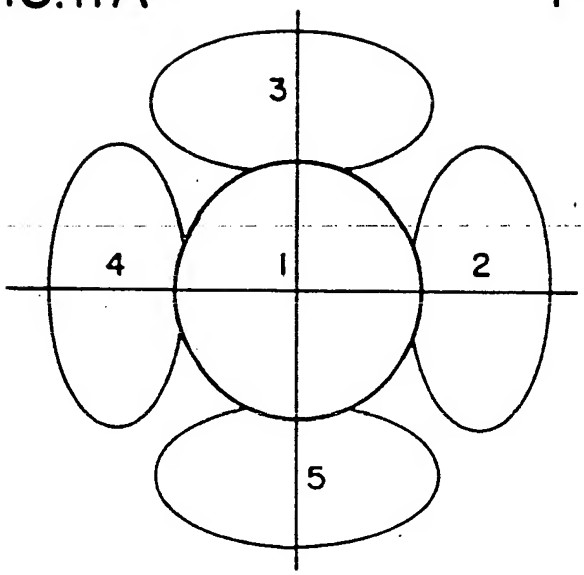
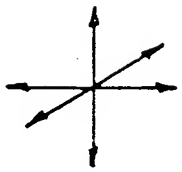


FIG.11A



BEAM PATTERN COVERAGE USING PATCH LIKE ANTENNA (PROJECTION VIEW)

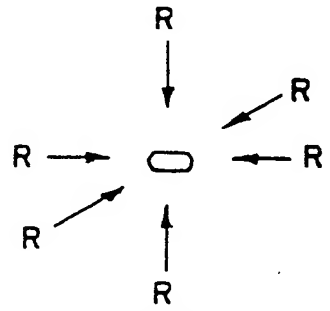
FIG.11B



POLARIZATION AXES
POLARIZATION COVERAGE

SPATIAL DISCRIMINA
-TION MULTI-READ
POINTS
SPATIAL COVERAGE

FIG.11C



R = READERS

FIG.12A

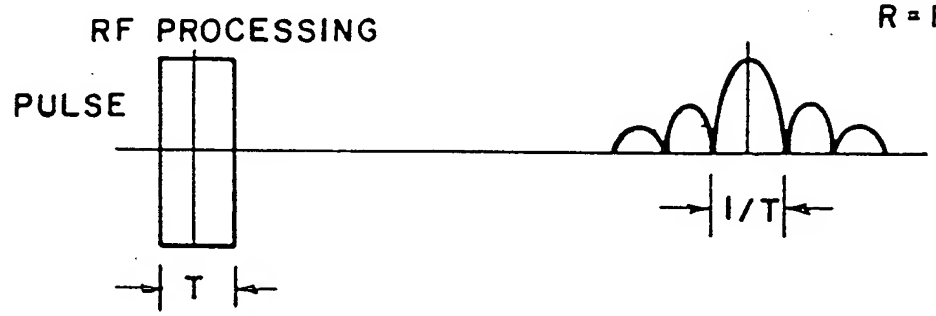


FIG.12B

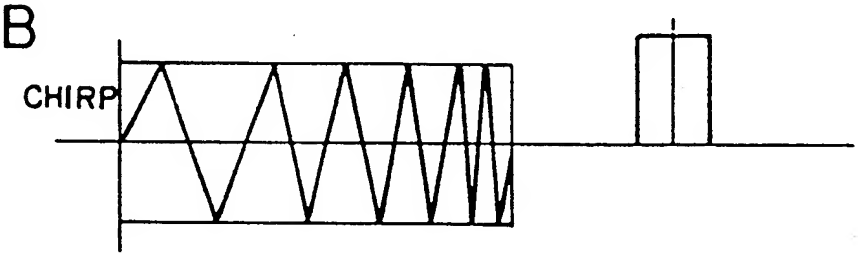


FIG.12C

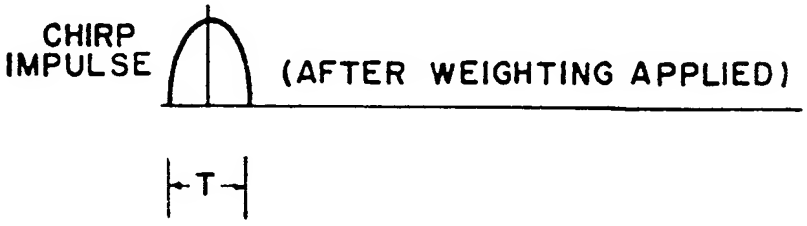
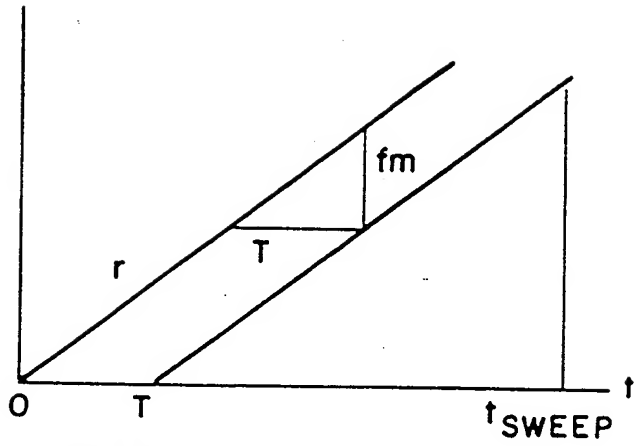


FIG.12D



$fm = Tr$

t_{SWEEP} = SWEEP TIME

$1/t_{SWEEP}$ = NOISE BANDWIDTH OF DETECTOR

FIG.13

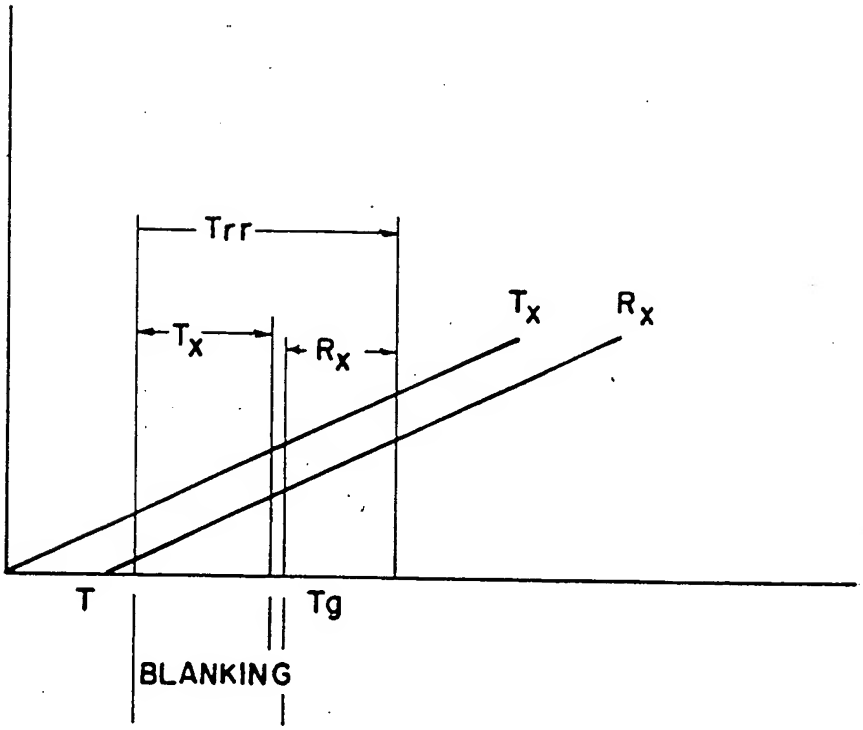
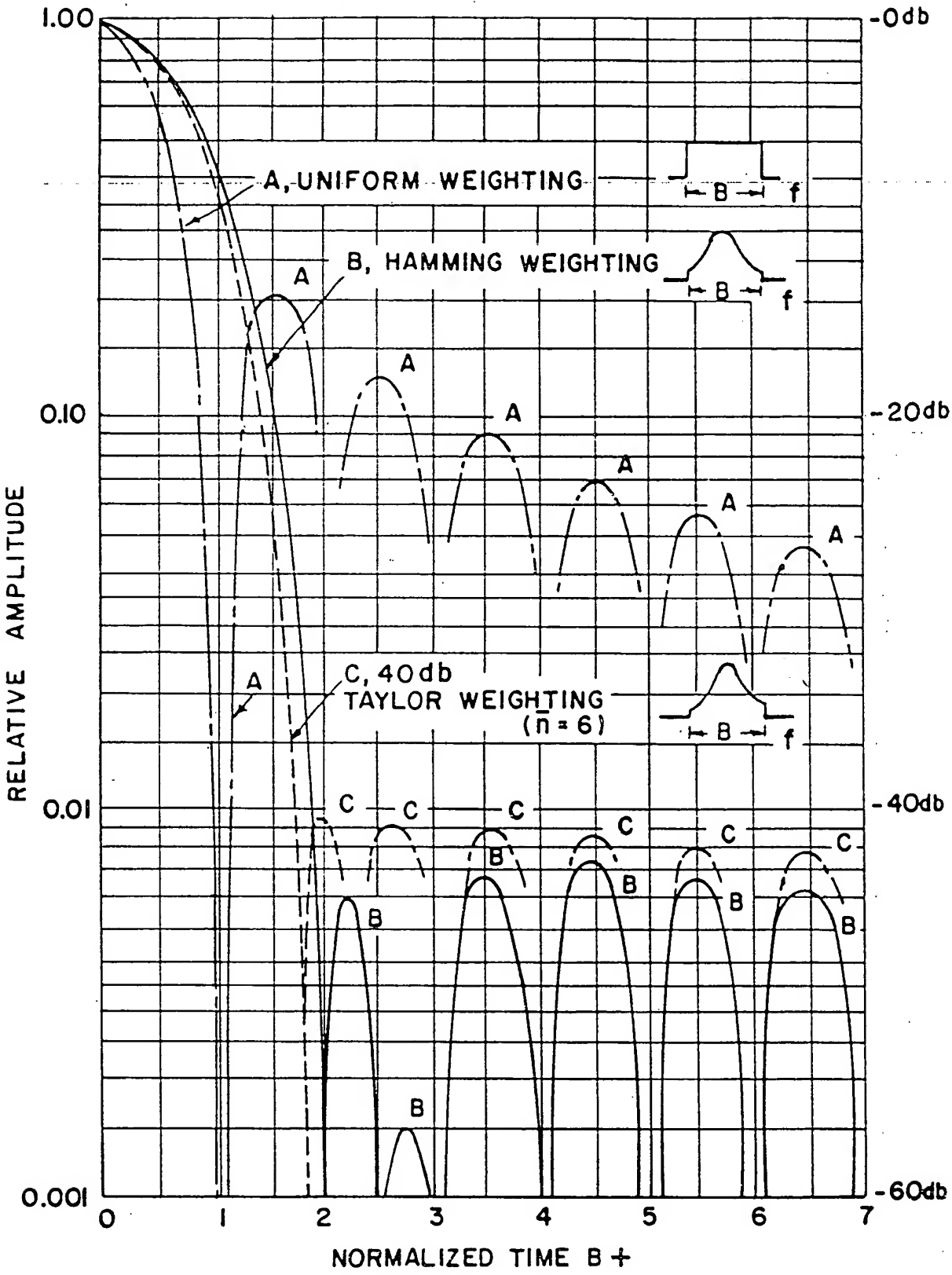
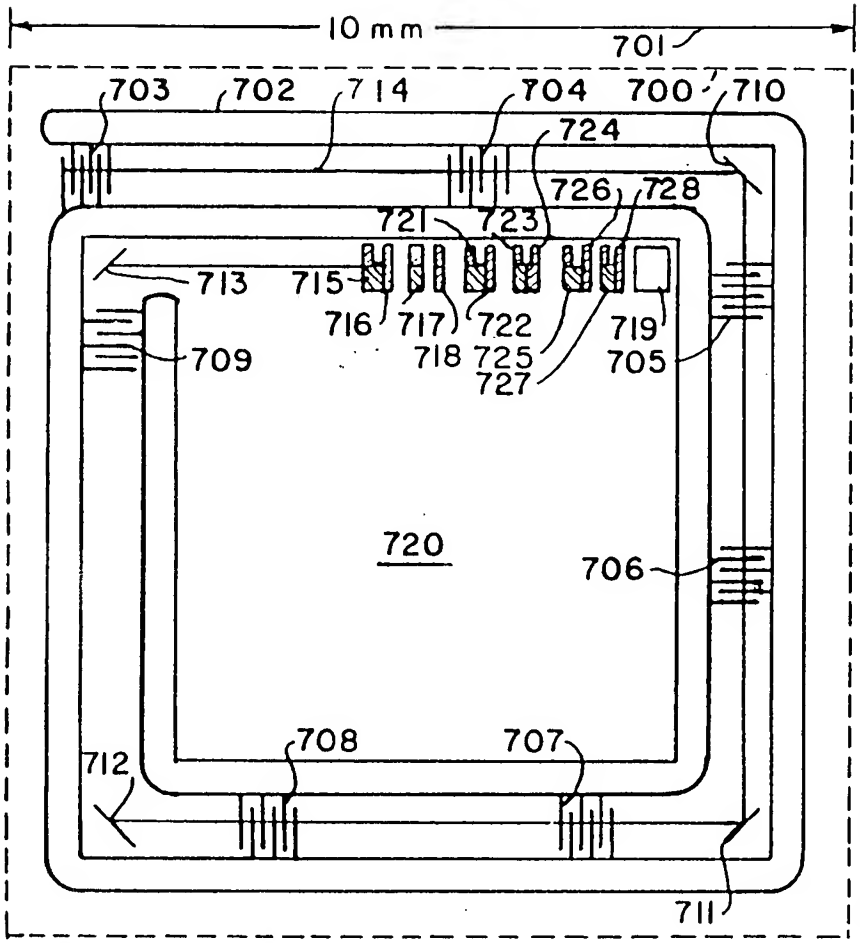


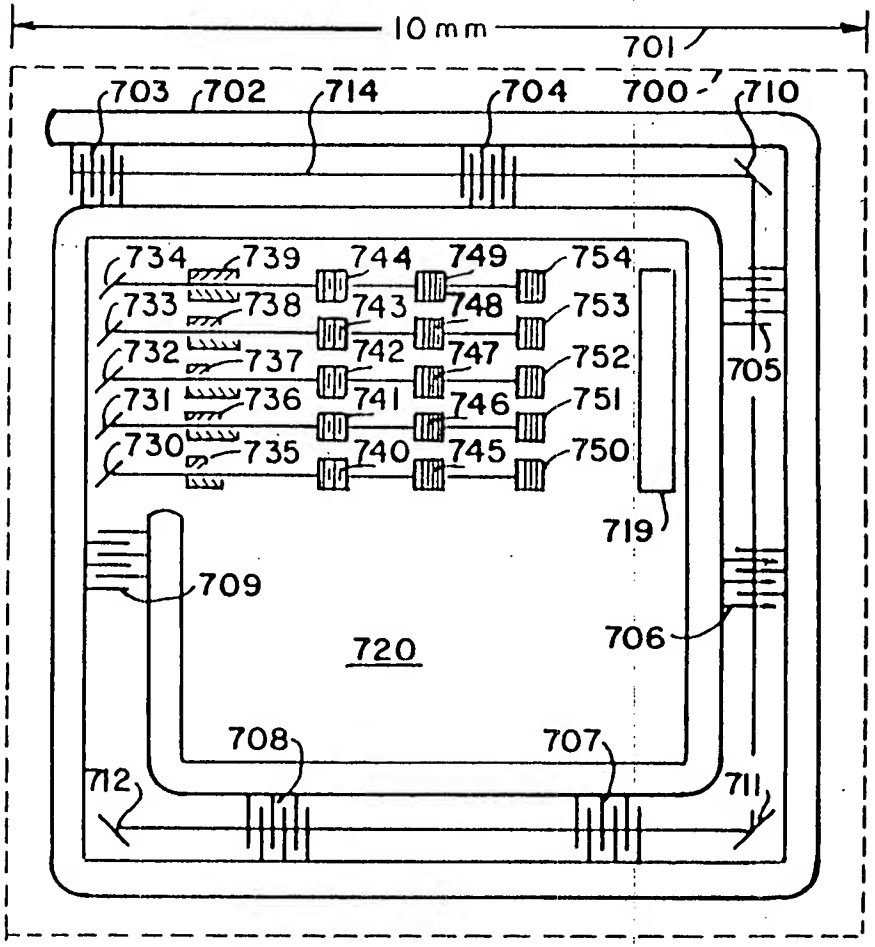
FIG.14


1.00
0.10
0.01
0.001
-0db
-20db
-40db
-60db
RELATIVE AMPLITUDE
A, UNIFORM WEIGHTING
B, HAMMING WEIGHTING
C, 40db TAYLOR WEIGHTING (n̄ = 6)
B
f
0
1
2
3
4
5
6
7
NORMALIZED TIME B ÷



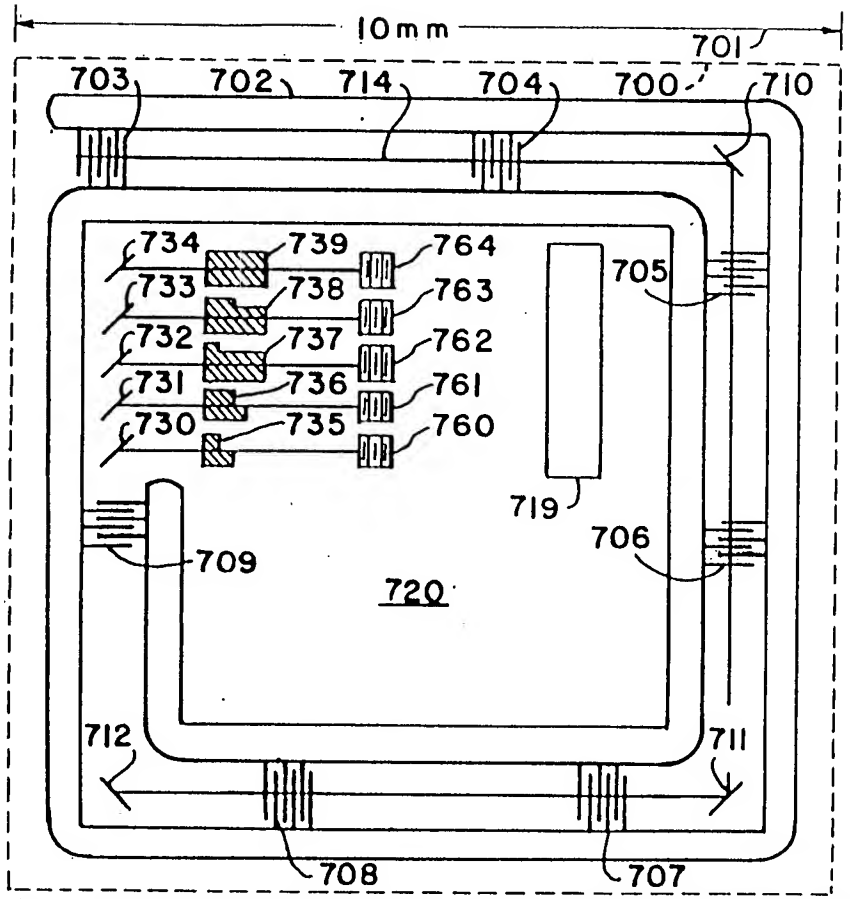
TRANSDUCER SELECTED FOR I OF Nf FREQ BANDS
HIGH EFFICIENCY CORNER REFLECTOR
AMPLITUDE WEIGHTED DELAY PAD
BROAD BAND PARTIAL REFLECTOR

FIG.15



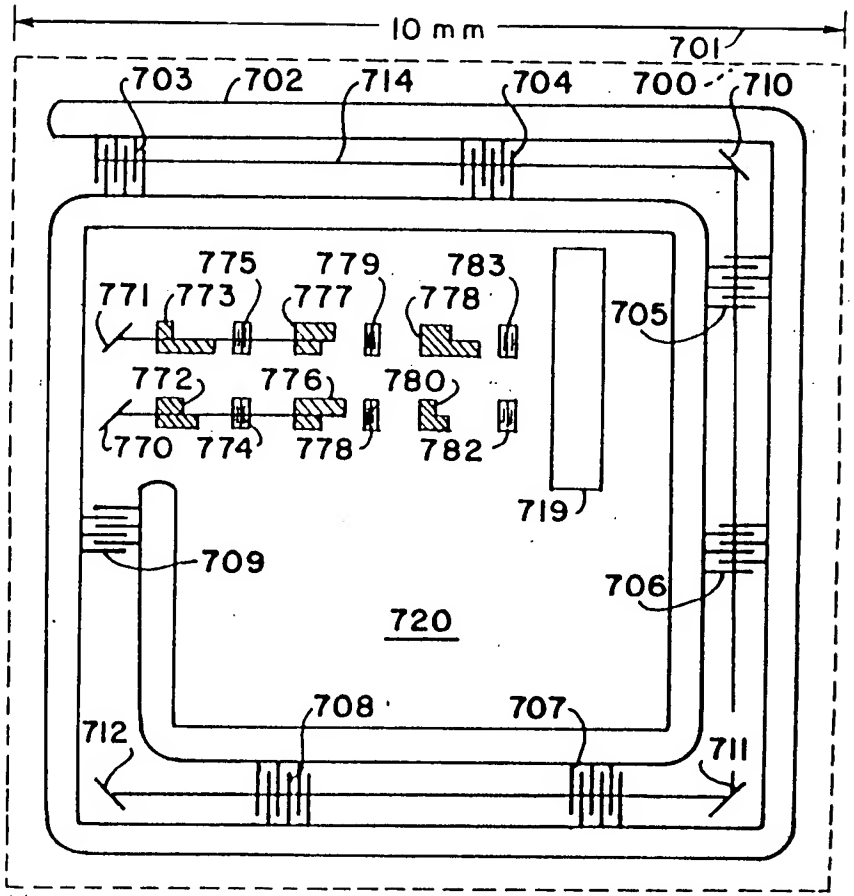
TRANSDUCER SELECTED FOR I OF Nf FREQ. BANDS
HIGH EFFICIENCY CORNER REFLECTOR
PARTIAL 90 DEG. REFLECTOR
AMPLITUDE WEIGHTED DELAY PAD
FREQUENCY SELECTIVE REFLECTOR

FIG.16



TRANSDUCER SELECTED FOR I OF Nf FREQ. BANDS
HIGH EFFICIENCY CORNER REFLECTOR
PARTIAL 90 DEG. REFLECTOR
AMPLITUDE WEIGHTED DELAY PAD
BROAD BAND REFLECTOR

FIG.17



TRANSDUCER SELECTED FOR I OF Nf FREQ. BANDS
HIGH EFFICIENCY CORNER REFLECTOR
PARTIAL 90 DEG. REFLECTOR
AMPLITUDE WEIGHTED DELAY PAD
BROAD BAND PARTIAL REFLECTOR

FIG.18

FIG.19A

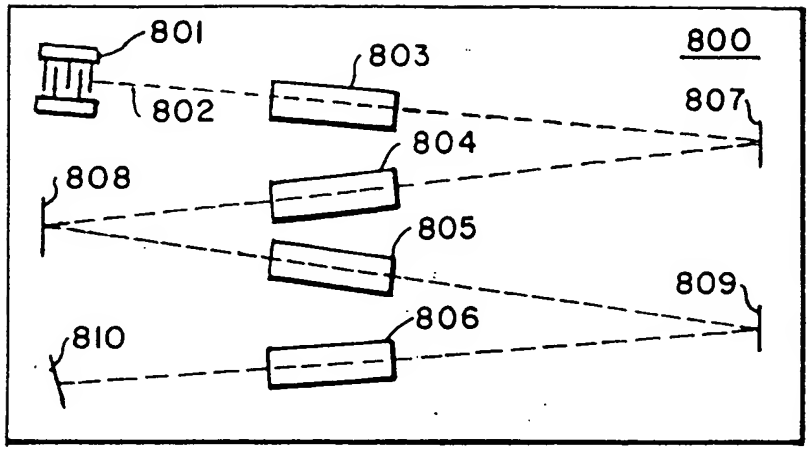


FIG.19B

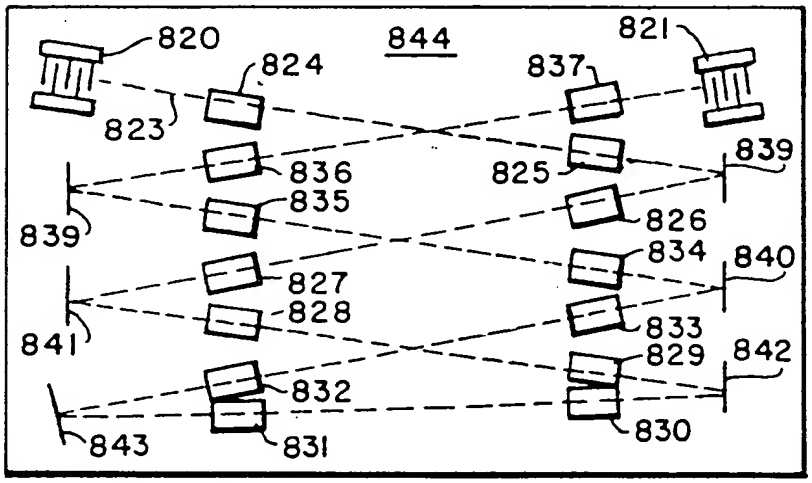
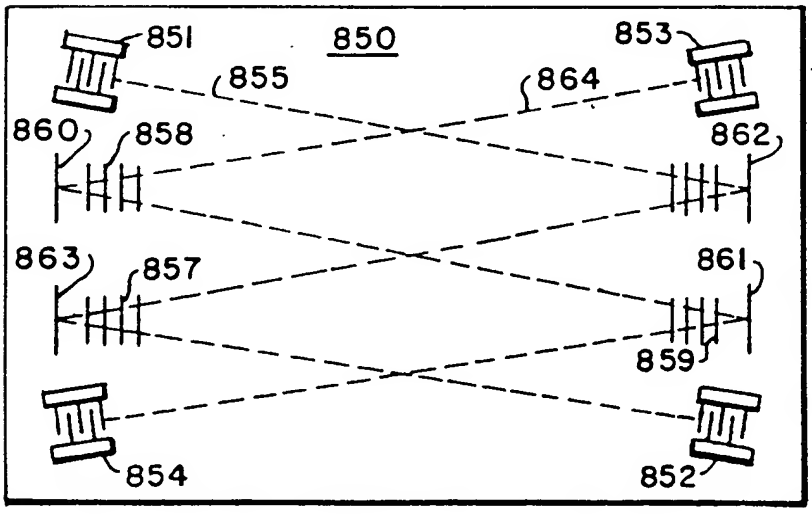


FIG.19C



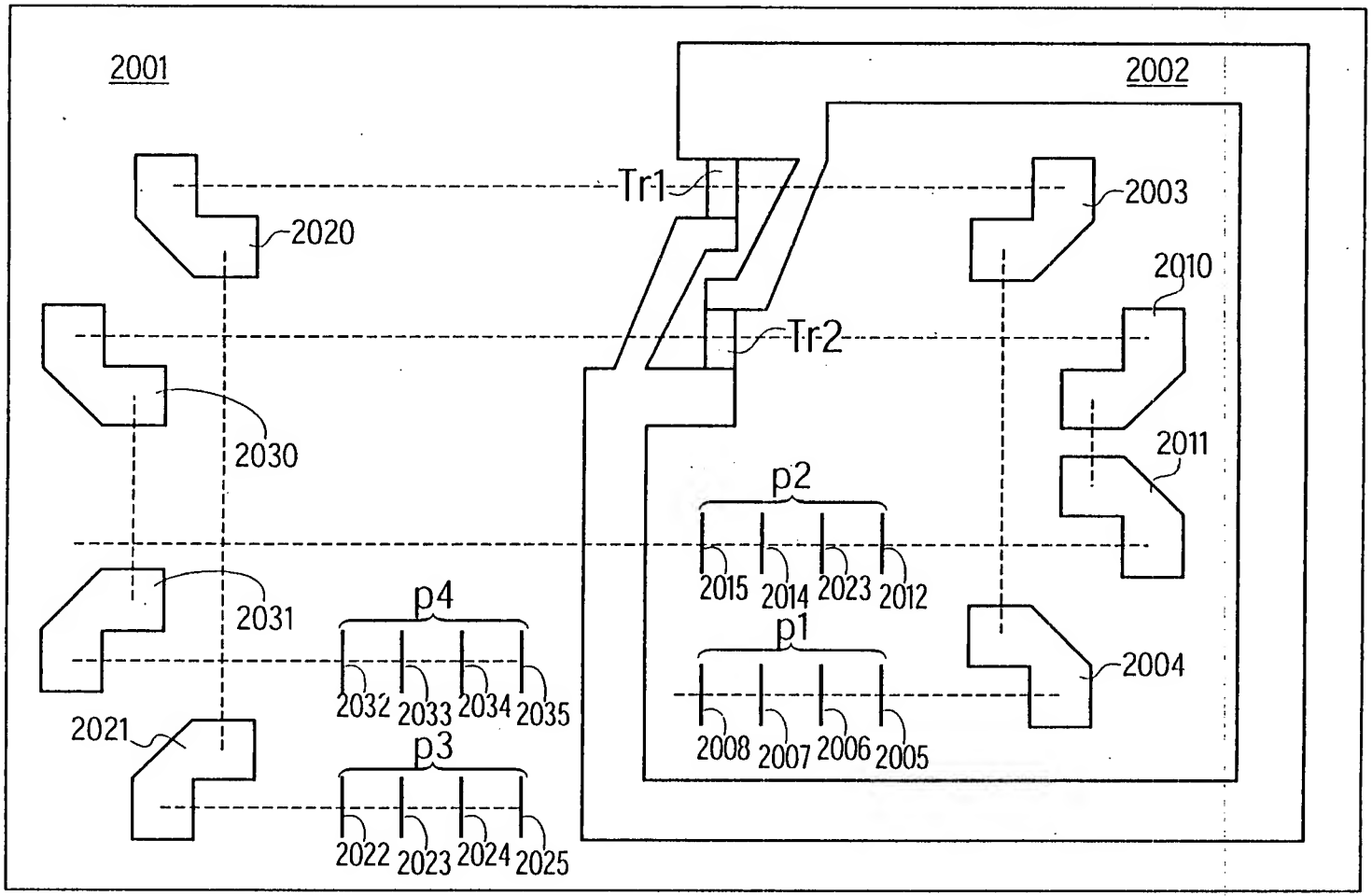

2001
2002
Tr1
Tr2
2020
2003
2010
2030
2011
p2
2015
2014
2023
2012
2031
p4
p1
2004
2032
2033
2034
2035
2008
2007
2006
2005
2021
p3
2022
2023
2024
2025

Fig. 20

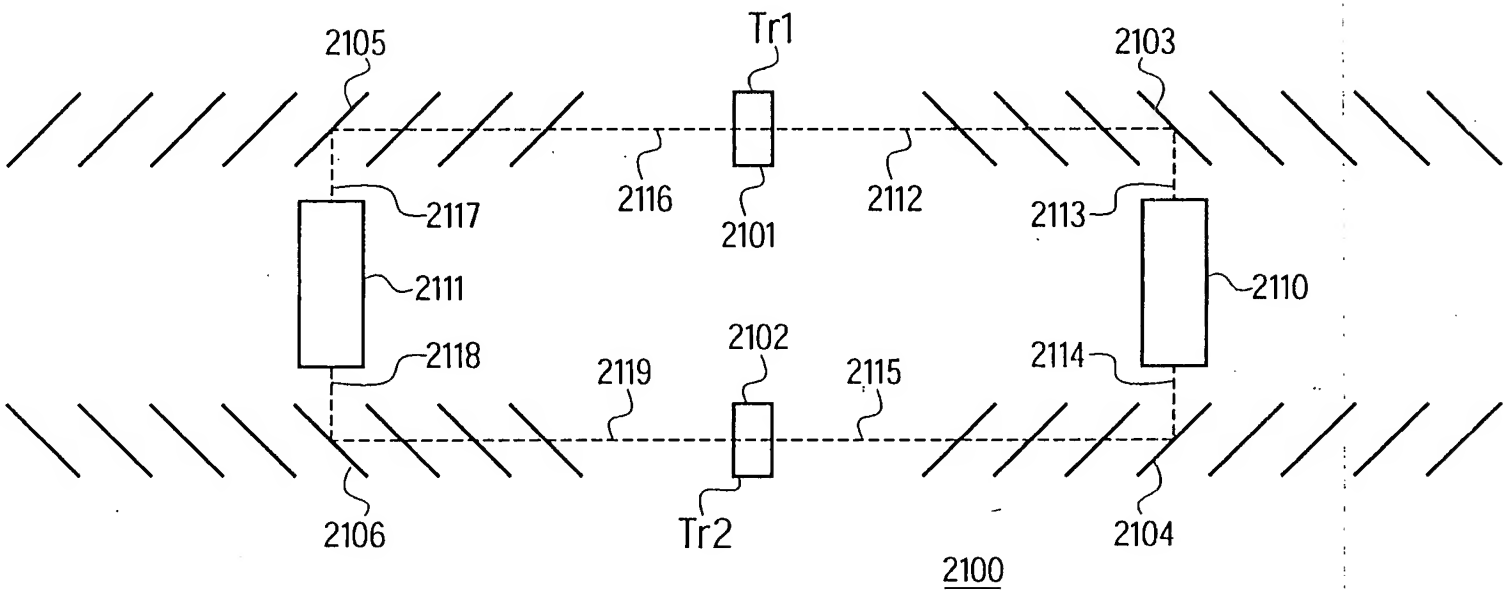

2105
Tr1
2103
2117
2116
2101
2112
2113
2111
2110
2118
2102
2119
2115
2114
2106
Tr2
2104
2100

Fig. 21

Calculation of element reflection and resultant loss per tap (excluding transducer loss) for 16 tap RAC. (8 taps on each side of transducers)

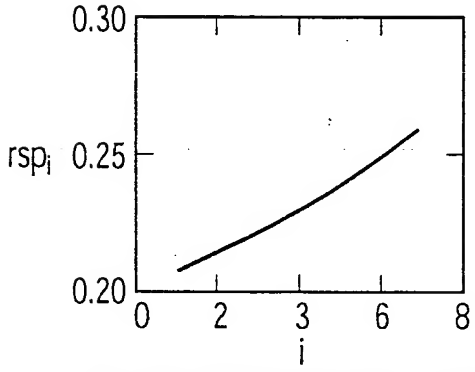
Parameters: top = prop. loss between taps (200ns delay)
rsp0 = refl. coeff. of 1st tap (one RAC element)
rl0 = prop. loss of first tap (1 μs delay)(dB)

$top := 0.977 \qquad rp_0 = 0.04 \qquad rl_0 := 1.0 \qquad rsp_0 := \sqrt{rp_0}$

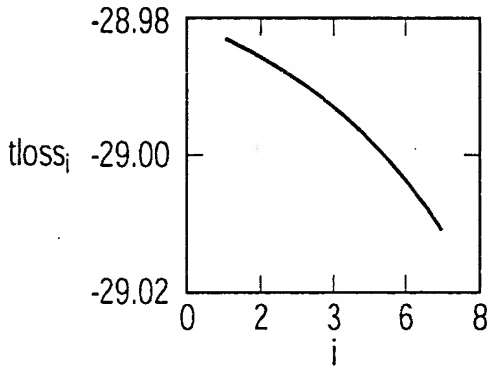
$i := 1..7 \qquad rp_i := \frac{rp_{i-1}}{1 - rp_{i-1}} \cdot \frac{1}{top} \qquad rl_i := (1 - rp_i) \cdot top \cdot \frac{rp_i}{rp_{i-1}} \qquad rsp_i := \sqrt{rp_i}$

$tloss_i := 20 \cdot \log(rl_i \cdot rp_0) - 1.0 \qquad tloss_0 := 20 \cdot \log(rp_0) - 1.0$

$$rsp = \begin{bmatrix} 0.2 \\ 0.207 \\ 0.214 \\ 0.221 \\ 0.229 \\ 0.238 \\ 0.248 \\ 0.259 \end{bmatrix} \qquad rl = \begin{bmatrix} 1 \\ 0.997 \\ 0.997 \\ 0.997 \\ 0.996 \\ 0.996 \\ 0.995 \\ 0.994 \end{bmatrix} \qquad tloss = \begin{bmatrix} -28.959 \\ -28.983 \\ -28.986 \\ -28.989 \\ -28.993 \\ -28.998 \\ -29.004 \\ -29.011 \end{bmatrix}$$



element reflection as funct. of tap #



Transm. loss as funct. of tap #, dB

Fig. 22

Calculation of element reflection and resultant loss per tap (excluding transducer loss) for 16 tap RAC. (8 taps on each side of transducers)

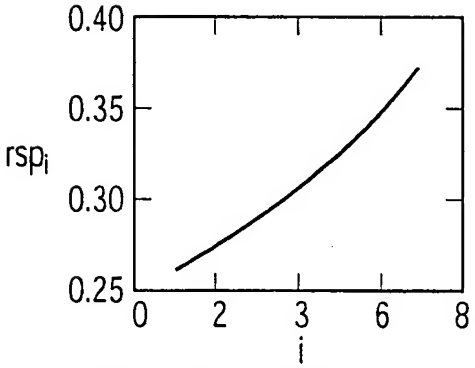
Parameters: top = prop. loss between taps (200ns delay)
rsp0 = refl. coeff. of 1st tap (one RAC element)
rl0 = prop. loss of first tap (1 μs delay)(dB)

$top := 0.977 \qquad rp_0 = 0.0625 \qquad rl_0 := 1.0 \qquad rsp_0 := \sqrt{rp_0}$

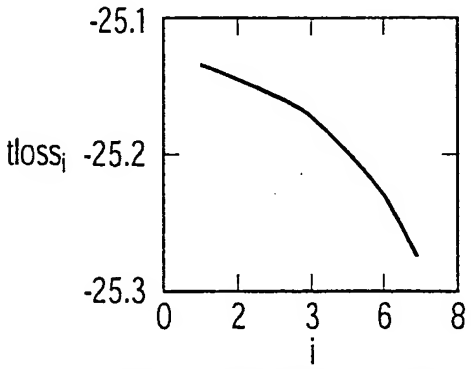
$i := 1..7 \qquad rp_i := \frac{rp_{i-1}}{1 - rp_{i-1}} \cdot \frac{1}{top} \qquad rl_i := (1 - rp_i) \cdot top \cdot \frac{rp_i}{rp_{i-1}} \qquad rsp_i := \sqrt{rp_i}$

$tloss_i := 20 \cdot \log(rl_i \cdot rp_0) - 1.0 \qquad tloss_0 := 20 \cdot \log(rp_0) - 1.0$

$$rsp = \begin{bmatrix} 0.25 \\ 0.261 \\ 0.274 \\ 0.288 \\ 0.304 \\ 0.323 \\ 0.345 \\ 0.372 \end{bmatrix} \qquad rl = \begin{bmatrix} 1 \\ 0.994 \\ 0.993 \\ 0.991 \\ 0.989 \\ 0.987 \\ 0.983 \\ 0.978 \end{bmatrix} \qquad tloss = \begin{bmatrix} -25.082 \\ -25.136 \\ -25.145 \\ -25.158 \\ -25.174 \\ -25.197 \\ -25.228 \\ -25.275 \end{bmatrix}$$



element reflection as funct. of tap #



Transm. loss as funct. of tap #, dB

Fig. 23

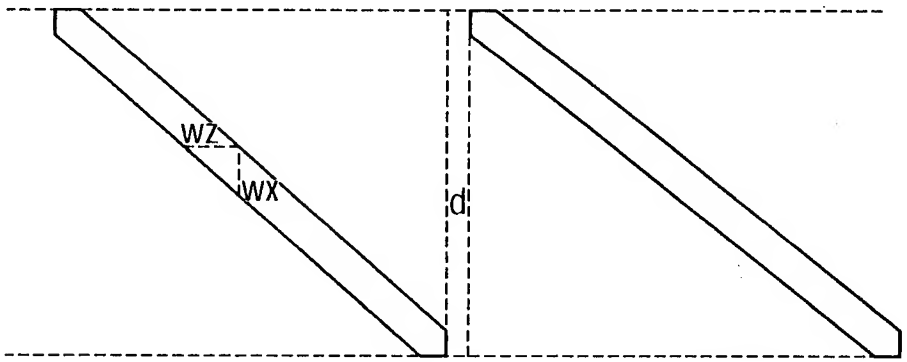


Fig. 24

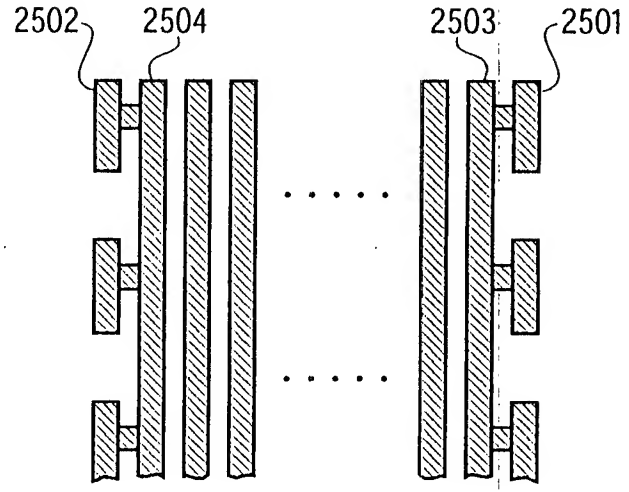


Fig. 25

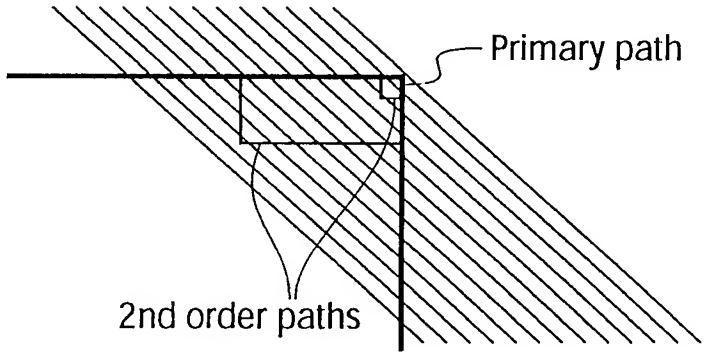


Fig. 26

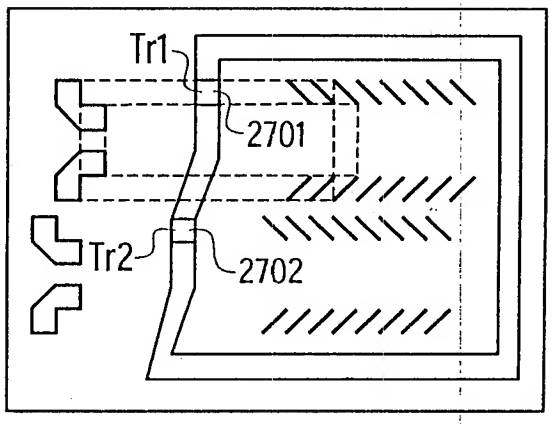
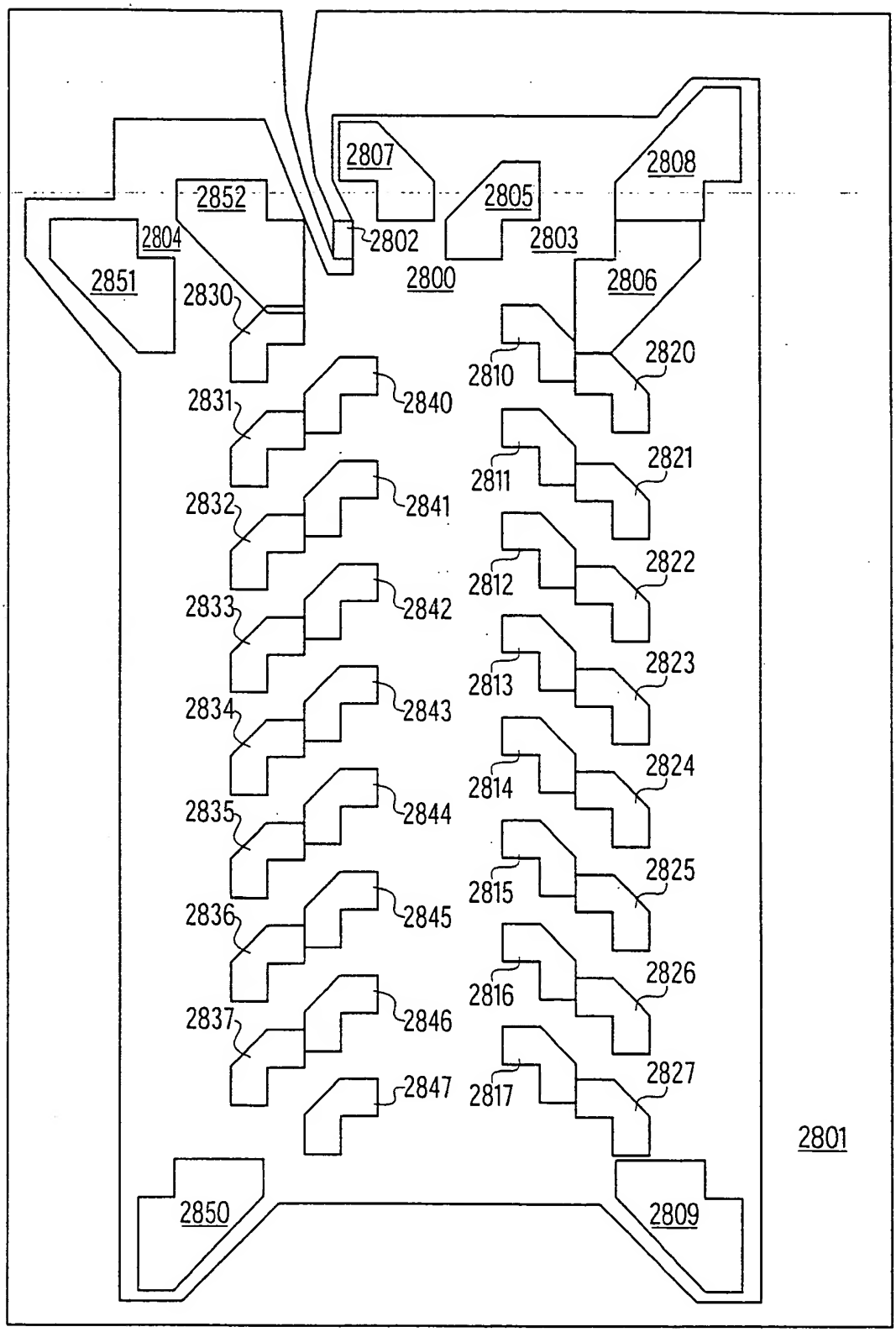


Fig. 27


2807
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2800
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2810
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2811
2832
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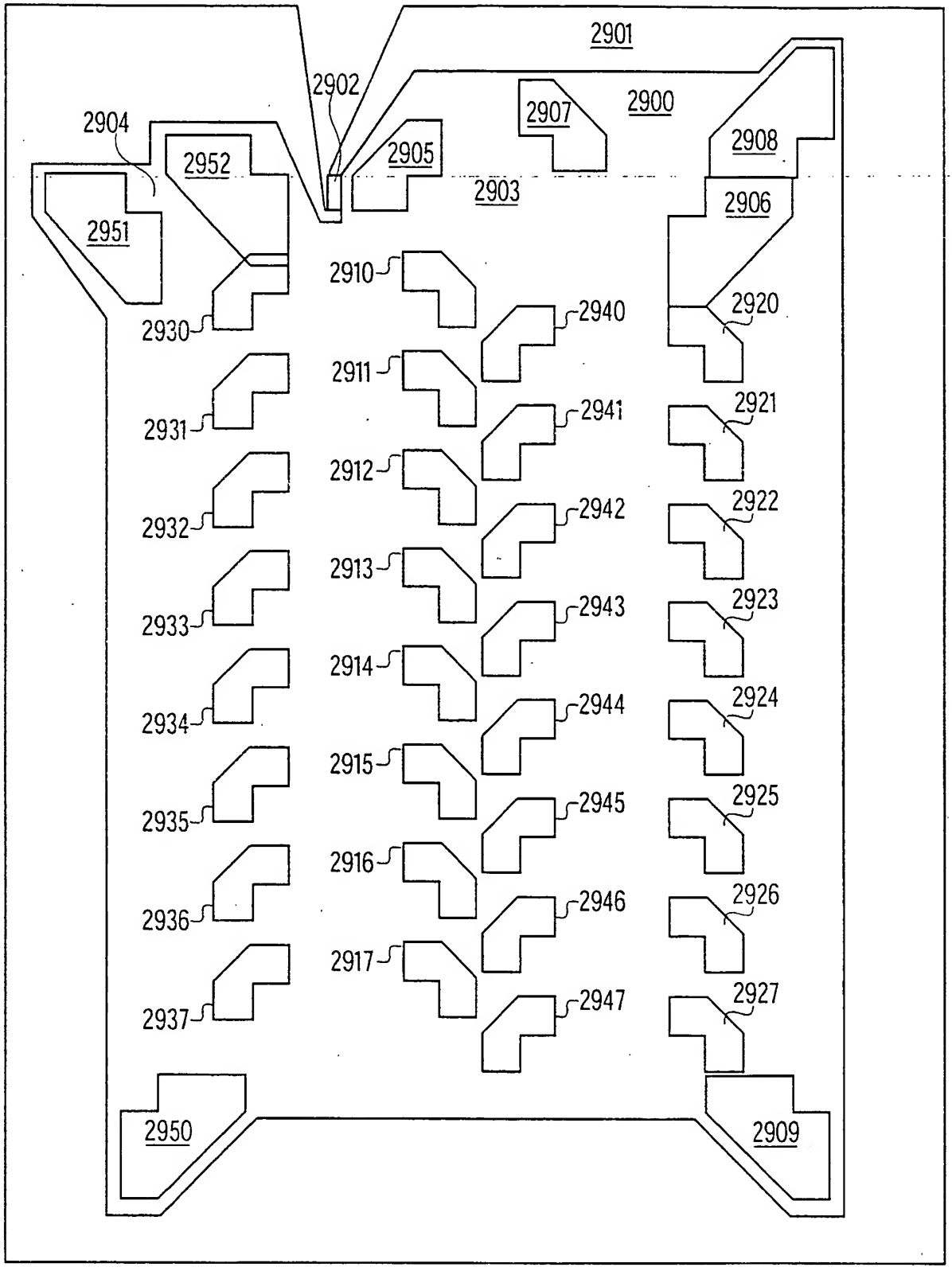
2801
2850
2809

Fig. 28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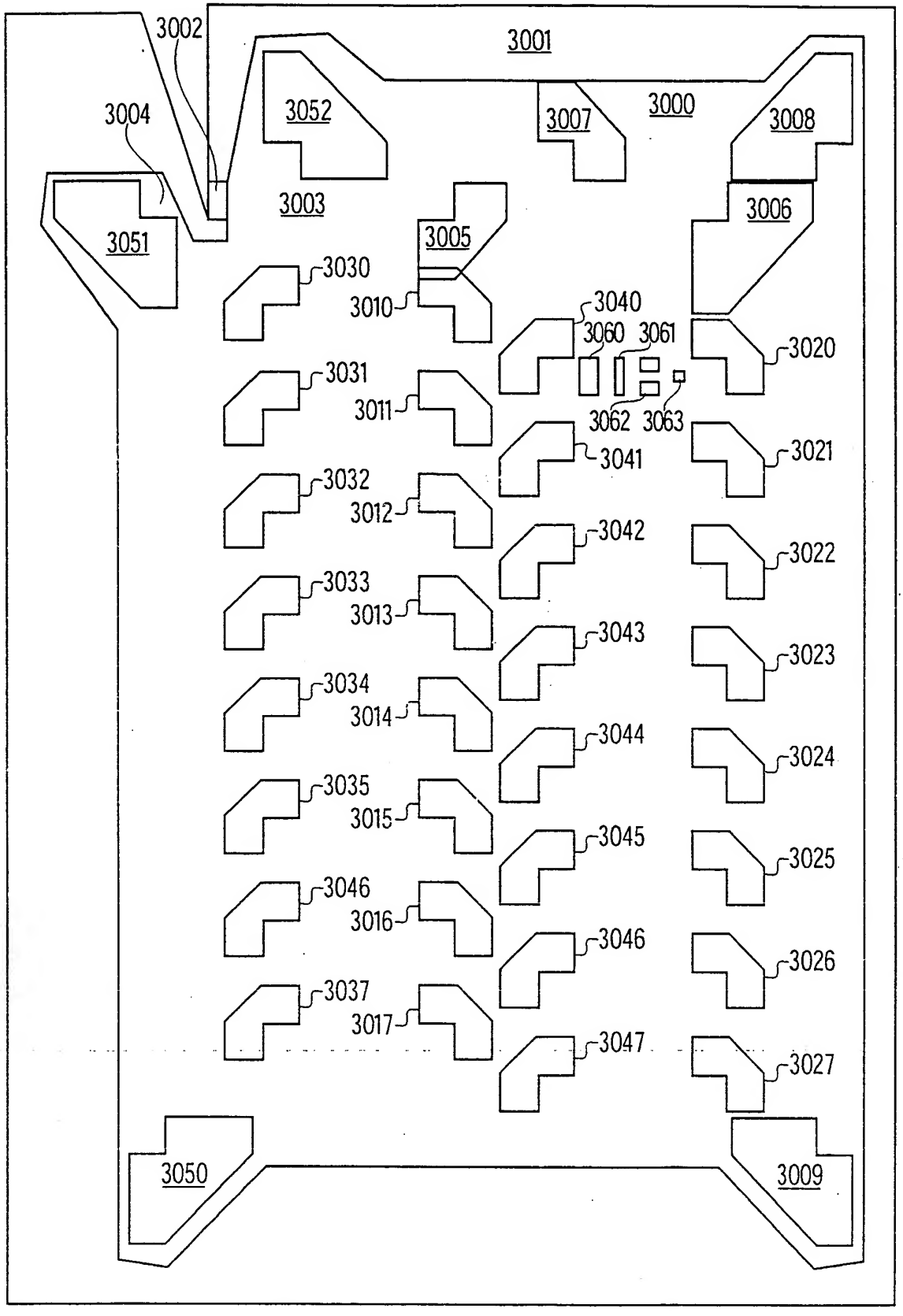
2950
2909

Fig. 29


3002
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3052
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3000
3008
3003
3006
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3005
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3010
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3017
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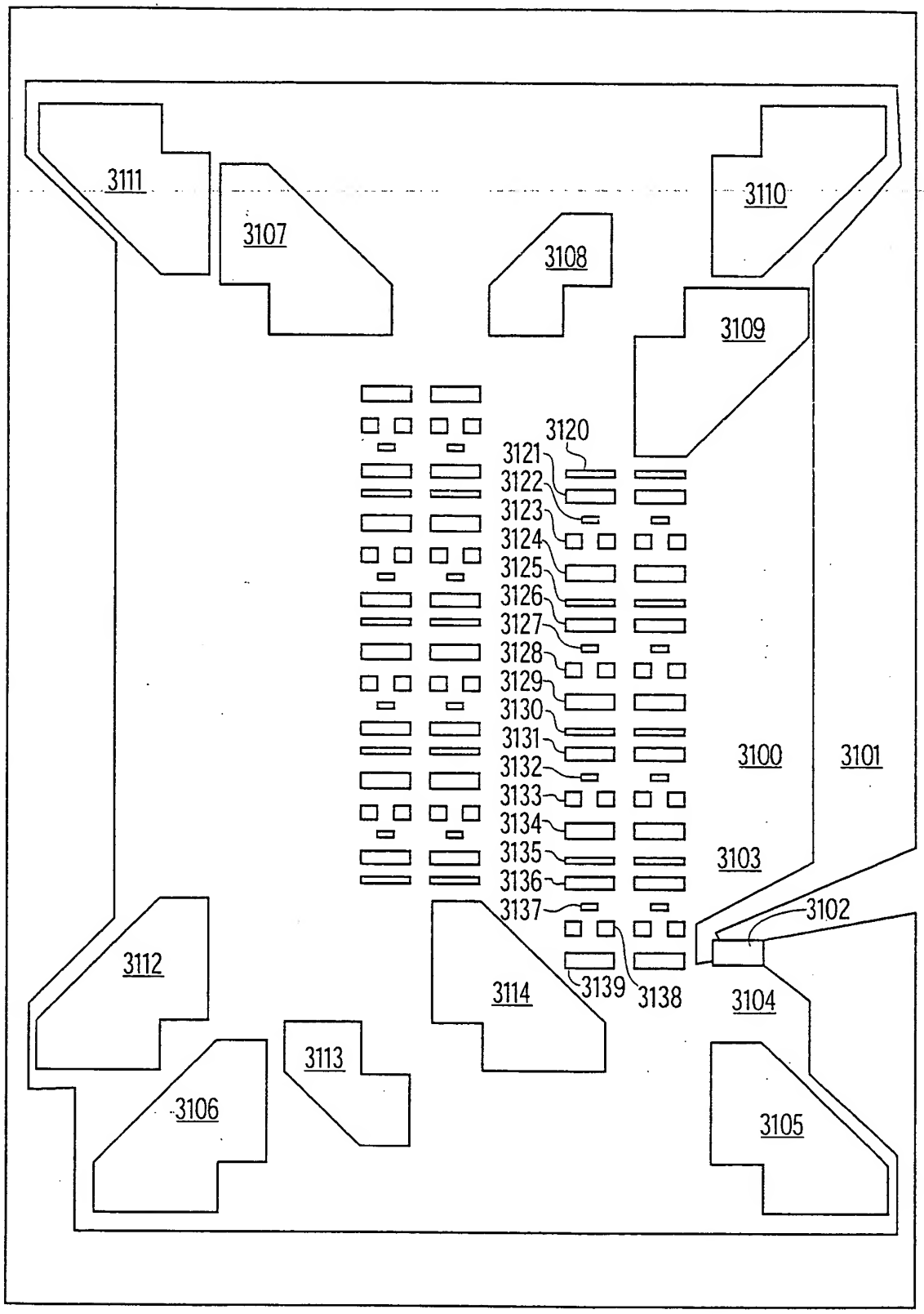
3050
3009

Fig. 30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3107
3108
3110
3109
3120
3121
3122
3123
3124
3125
3126
3127
3128
3129
3130
3131
3132
3133
3134
3135
3136
3137
3100
3101
3103
3102
3112
3114
3139
3138
3104
3113
3106
3105

Fig. 31

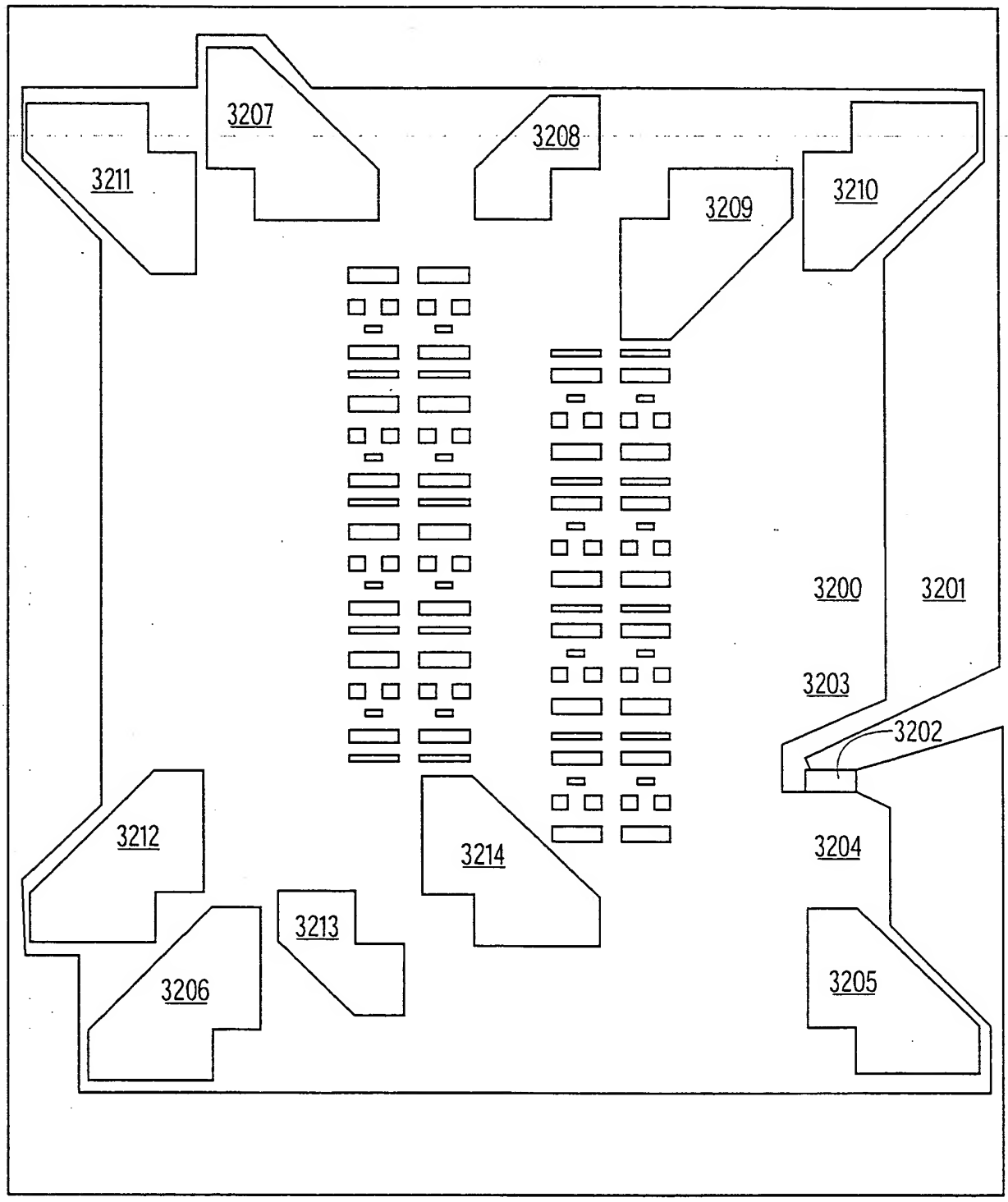
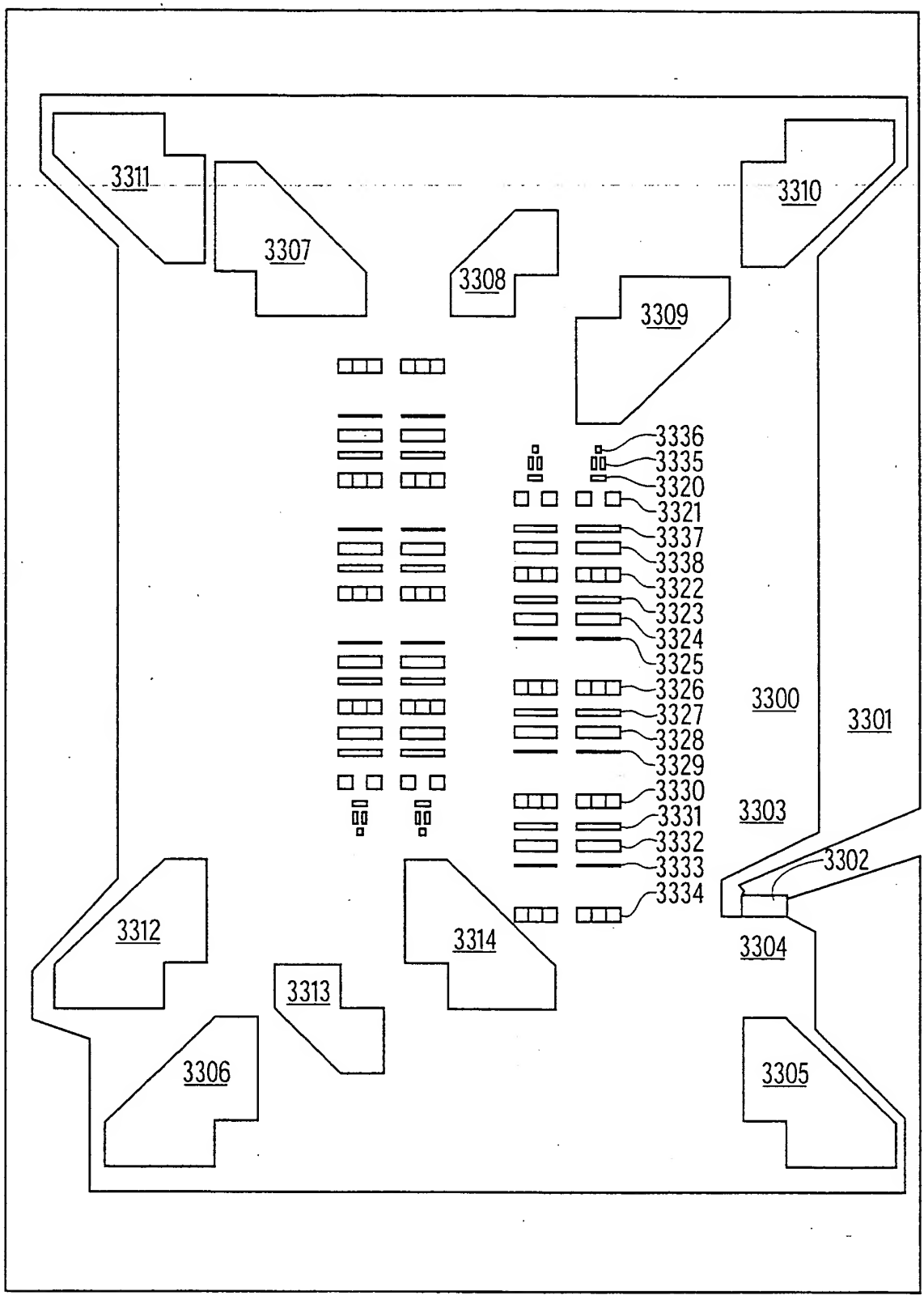

3207
3208
3211
3209
3210
3200
3201
3203
3202
3212
3214
3204
3213
3206
3205

Fig. 32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3307
3308
3310
3309
3336
3335
3320
3321
3337
3338
3322
3323
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3326
3327
3328
3329
3330
3331
3332
3333
3334
3300
3301
3303
3302
3304
3312
3314
3313
3306
3305

Fig. 33

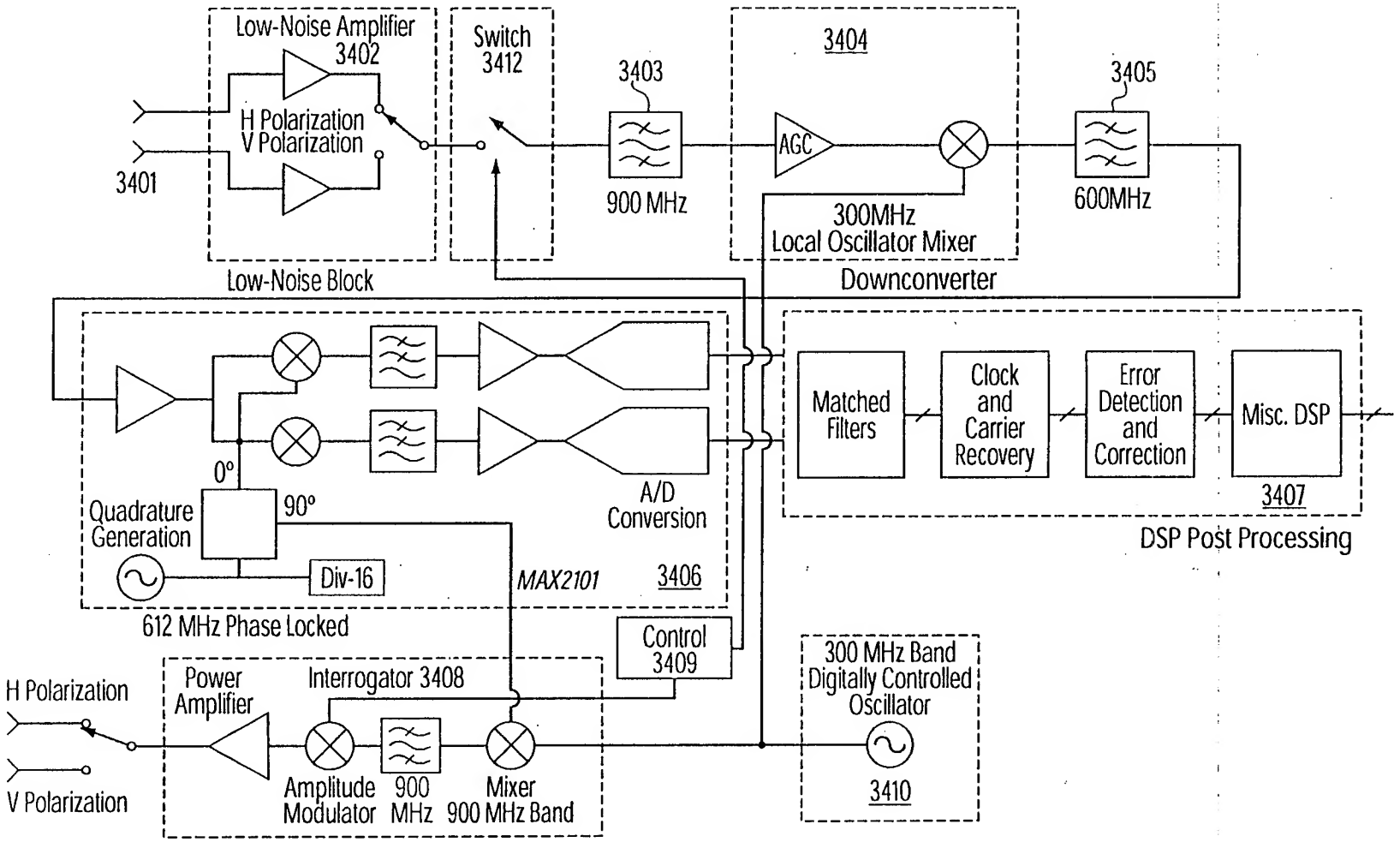
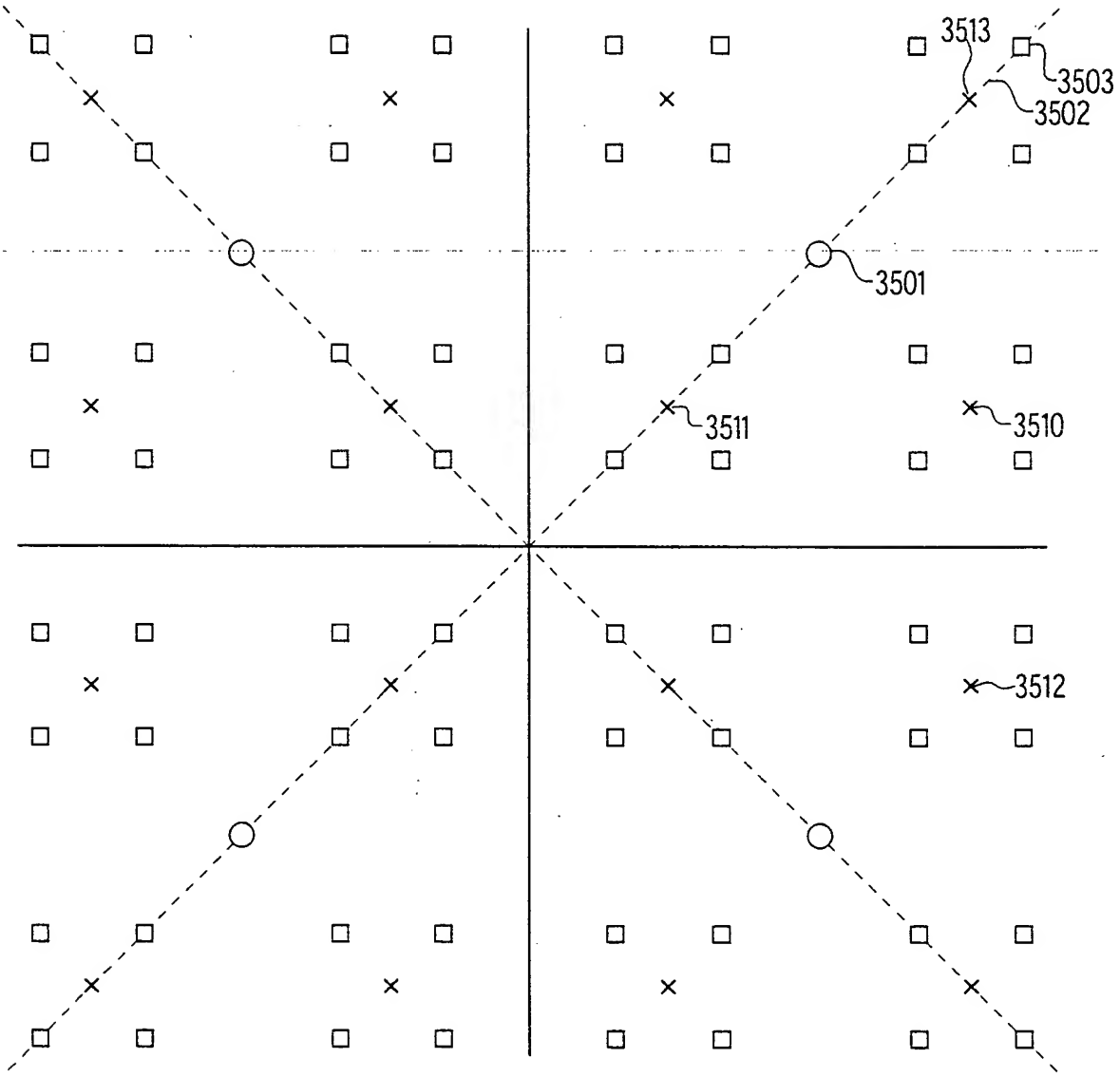

Low-Noise Amplifier
3402
H Polarization
V Polarization
3401
Switch
3412
3403
900 MHz
3404
AGC
300MHz
Local Oscillator Mixer
3405
600MHz
Low-Noise Block
Downconverter
0°
90°
Quadrature
Generation
Div-16
MAX2101
3406
612 MHz Phase Locked
A/D
Conversion
Matched
Filters
Clock
and
Carrier
Recovery
Error
Detection
and
Correction
Misc. DSP
3407
DSP Post Processing
Control
3409
H Polarization
V Polarization
Power
Amplifier
Interrogator 3408
Amplitude
Modulator
900
MHz
Mixer
900 MHz Band
300 MHz Band
Digitally Controlled
Oscillator
3410

Fig. 34



QAM-64

Fig. 35A

Phase Splitting

$\frac{\pi}{2}$	+	+	-	-
$\frac{\pi}{4}$	+	-	+	-
result	3510	3511	3512	3513

Fig. 35B